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High Power Ultrasonics as a Diagnostics and Treatment Tool

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ABSTRACT

In parallel to the industrial application of NDE to flaw detection and material property determination, the medical community has successfully adapted such methods to the noninvasive diagnostics and treatment of many conditions and disorders of the human body. As in NDT, medical testing relied heavily on visual and acoustic methods. The introduction of radiography, MRI, electromagnetics and ultrasonics as well as computers and imaging devices have made an enormous impact on the field of medical diagnostics. In spite of various collaborations between individuals from industry and medicine, the two communities were essentially working separately, although using similar tools. A turning point for ASNT occurred during the 1997 Fall ASNT Conference, where two sessions were held on the subject of Medical Diagnostics [1]. The objective was to bring medical doctors and NDT experts together. Such a synergistic pairing led to the sharing of techniques that were already developed and in use by experts in the complementary field. An example of such a success is the use of the CAT (Computed Axial Tomography) scan, which first became a standard medical diagnostic method and then was adapted to the NDE of composite structures.

In 1980, R. L. Crane and T. Moran from the Air Force Materials Laboratory used a medical CAT-scan system to demonstrate the unique capability of the CAT scan to detect flaws, and thus paved the path for this method to become a standard NDE technique. Another example is the MRI (Magnetic Resonance Imaging), which is widely used for medical diagnostics, and it still being explored for practical NDE usage. The authors recognized the potential of joint efforts between the medical and industrial communities, and in August 1995 started exploring cooperative efforts with an emphasis on the destruction of blood clots. The tool common to these investigators had been the use of ultrasonics [2]. Ultrasound offers a wide range of diagnostic and treatment capabilities that result from the broad frequency range, variety of modes and the options of low and high power levels that are available. Medical ultrasonics offers safe, accurate and cost-effective tools for diagnosis and treatment, where no known health hazard is associated with its use at low-power. Noninvasive medical treatment is theoretically superior to invasive surgery, as there should be less tissue injury, pain, blood loss and more rapid healing. For NASA, the availability of such technology is very important. The eventual human habitation of space calls for the development of specialized medical technology that addresses the unique problems of space medicine. The authors are directing their current efforts to the application of high power ultrasonics as a method of diagnostics and treatment tool for medical applications and these applications will be reviewed.